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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/690,479	10/22/2003	Masato Yamada	SUG-173-USAP	3859
28892	7590	03/30/2005	EXAMINER	
SNIDER & ASSOCIATES P. O. BOX 27613 WASHINGTON, DC 20038-7613			LOUIE, WAI SING	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 03/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/690,479

Applicant(s)

YAMADA ET AL.

Examiner

Wai-Sing Louie

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 March 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-64 is/are pending in the application.
- 4a) Of the above claim(s) 14, 15, 41, 63 and 64 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13, 16-20, 23-40, 42-45 and 48-62 is/are rejected.
- 7) ☒ Claim(s) 21, 22, 46 and 47 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 6/16/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Applicant's election without traverse of Group I, claims 1-13, 16-40, AND 42-62, in the reply filed on 3/7/05 is acknowledge. It is suggested that non-elected claims 14-15, 41, AND 63-64 be canceled in the response to this Office Action.

Claim Objections

Claim 6 is objected as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention:

- it is unclear, what is meant by "phosphor-blocking layer". For the purpose of examination, "a phosphorus-containing current-blocking layer" is assumed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-13, 16-19, 23-27, 29-34, 36-37, 40, 42-45, 48-51, 54-59, and 61-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,977,565) in view of Tanizawa (US 6,838,705).

With regard to claims 1 and 59, Ishikawa et al. disclose a semiconductor light-emitting diode, LED, (col. 5, line 61 to col. 15, line 29 and fig. 2a) comprising:

- a light-emitting layer 103 portion composed of a compound semiconductor, and has a double heterostructure, DH, (col. 6, line 35-41 and fig. 2a) in which a first conductivity type cladding layer 102, an active layer 103 and a second conductivity type cladding layer 104 are stacked in this order (fig. 2a);
- an ITO oxide transparent electrode layer 107 cover the main surface of the second conductivity type cladding layer 104, and being provided for applying emission drive voltage to the light-emitting layer 103 portion (col. 6, lines 61-64 and fig. 2a); further comprising:
 - a bonding pad 108 composed of a metal (col. 7, lines 11-13 and col. 10, lines 16-19) and disposed on the oxide transparent electrode layer 107, and having a electrode wire for current supply bonded (see fig. 8);
 - Ishikawa et al. do not disclose a cushion layer disposed between the second conductivity type cladding layer and the oxide transparent electrode layer, and comprising a compound semiconductor layer having a dopant concentration lower than that of the second conductivity type cladding layer. However, Tanizawa discloses a p-type low-doped layer 9 formed on the second conductivity type cladding layer 8 (col. 17, lines 35-63 and fig. 1). Tanizawa teaches the LED could have higher luminous intensity as well as greater electrostatic withstanding voltage (col. 17, lines 46-48). Ishikawa et al. and Tanizawa have substantially the same

environment of a LED having DH structure. Therefore, it would have been obvious for the one with ordinary skill in the art to modify Ishikawa's device with the teaching of Tanizawa to provide a p-type low-doped (cushion) layer in between the second conductivity type cladding layer and the oxide transparent electrode layer in order to have higher luminous intensity as well as greater electrostatic withstanding voltage.

With regard to claims 2-3 and 18-19, Ishikawa et al. modified by Tanizawa in claim 1 above would disclose the thickness of the p-type low-doped layer 9 is from 100 through 10000Å (Tanizawa col. 19, lines 1-3) and Ishikawa et al. disclose the second conductivity type cladding layer is about 0.4 µm (col. 6, line 41). Since the applicant has not established the criticality of the thickness stated and since these thicknesses are in common use in similar devices in the art, it would have been obvious to one of ordinary skill in the art to use these values in the device. Where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With regard to claims 4, 6-13, 29-30, 34, 36, 40, 49-51, 54, 57-58, and 62, in addition to the limitations disclosed in claim 1 above, Ishikawa et al. modified by Tanizawa in claim 1 above would disclose:

- an electrode contact layer 10 for reducing junction resistance of the electrode layer (Tanizawa col. 8, lines 24-30), disposed between the p-type low-doped layer 9 and the electrode layer so as to contact with the oxide transparent electrode layer in Ishikawa's device;

- Ishikawa et al. disclose a phosphorus-containing compound semiconductor light-emitting device and, therefore, the p-type low-doped (cushion) layer would comprise a phosphorus-containing compound semiconductor layer containing phosphorus (col. 10, lines 1-10), and between the p-type low-doped layer 9 and the electrode contact layer 10 is a phosphorus-containing current-blocking layer 125 (fig. 5). Ishikawa et al. do not disclose the phosphorus-containing current-blocking layer 125 having a phosphorus content lower than that of the other phosphorus-containing compound semiconductor layers. However, Ishikawa et al. disclose the compound semiconductor is not limited to AlInGaP-based LED, AlGaAs-based can also be applied. Therefore, the current-blocking could be AlGaAs or AlGaAsP (col. 10, lines 47-51) and the electrode contact layer could be AlGaAs, which is a phosphorus-free compound semiconductor.

With regard to claim 5, Ishikawa et al. disclose a region (under the electrode 105) where no electrode contact layer 104 is formed there (fig. 8).

With regard to claims 16-17, 23, 37, and 61, in addition to the limitations disclosed in claim 1 above, Ishikawa et al. modified by Tanizawa also disclose:

- an electrode contact layer 10 for reducing junction resistance of the electrode layer (Tanizawa col. 8, lines 24-30), disposed between the p-type low-doped layer 9 and the electrode layer so as to contact with the oxide transparent electrode layer in Ishikawa's device;
- the doping concentration of electrode contact layer 10 is within the range of $1 \times 10^{18} \text{ cm}^{-3}$ through $5 \times 10^{21} \text{ cm}^{-3}$ (Tanizawa col. 20, lines 3-4). Since the applicant has

not established the criticality of dopant concentration stated and since these dopant concentrations are in common use in similar devices in the art, it would have been obvious to one of ordinary skill in the art to use these values in the device. Where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With regard to claim 24, Ishikawa et al. modified by Tanizawa would disclose the dopant concentration of the electrode contact layer 10 is equal to the second conductivity type cladding layer (Tanizawa col. 17, lines 58-61 and col. 20, lines 3-6).

With regard to claims 25-26 and 45, Ishikawa et al. disclose the formation area of the electrode contact layer 124 is smaller than the primary region, which locates right under the bonding, pad 109 including the region has no electrode contact layer 124 formed (fig. 5).

With regard to claims 27, 31-33, 44, and 55-56, Ishikawa et al. modified by Tanizawa would disclose the bonding-side semiconductor layer comprises a first layer (p-type low-doped layer 9) interface with electrode contact layer 10 and a second layer (p-type second conductivity type cladding layer 8) located between the first layer and the active layer 7; the second layer interface with the first layer (Tanizawa fig. 1). The first layer (p-type AlGaIn low-doped layer 9) having a bandgap energy larger than that of the GaN electrode contact layer 10 (Tanizawa col. 17, lines 43-44 and col. 19, lines 50-51). Ishikawa et al. disclose the LED device is made of AlInGaP, but do not disclose the first layer has a lower phosphorus content than that of the other phosphorus-containing layer. Since the applicant has not established the criticality of the

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phosphorus concentration stated and since these phosphorus concentrations are in common use in similar devices in the art, it would have been obvious to one of ordinary skill in the art to use these values in the device. Where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With regard to claims 42-43 and 48, in addition to the limitations disclosed in claims 1, 16, and 28 above, Ishikawa et al. modified by Tanizawa also disclose:

- the Al content in the second conductivity-type cladding layer 8 is greater than the p-type low-doped layer 9 (Tanizawa col. 17, lines 44-46) and the Al content in electrode contact layer 10 is lower than p-type low-doped layer 9, where the electrode contact layer 10 is a compound semiconductor layer (Tanizawa col. 19, lines 51-52).

Claims 20, 28, 35, 38-39, 52-53, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,977,565) modified by Tanizawa (US 6,838,705) as applied to claim 1 above, and further in view of Watanabe et al. (US 6,121,635).

With regard to claim 20, Ishikawa et al. modified by Tanizawa do not disclose the first conductivity type cladding layer is formed thinner than the second conductivity type cladding layer. However, Watanabe et al. disclose the first conductivity type cladding layer 105 has a thickness 0.6 μm and the second conductivity type cladding layer 107 has a thickness of 1.0 μm

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(Watanabe col. 10, line 67 to col. 11, line 2 and fig. 10). Watanabe et al. teach a predetermined distance is required between the ITO film and the active layer to achieve uniform electric field and current can flow uniformly in order to have the luminous efficiency (Watanabe col. 11, lines 32-43 and fig. 20). Ishikawa et al. and Watanabe et al. have substantially the same environment of LED having DH structure. Therefore, it would have been obvious at the time the invention was made to modify Ishikawa's device with the teaching of Watanabe et al. to have a thicker second conductivity type cladding layer than the first conductivity type cladding layer in order to achieve uniform electric field and current can flow uniformly in order to have the luminous efficiency.

With regard to claims 28, 35, 38-39, 52-53, and 60, in addition to the limitations disclosed in claims 1, 16, 20, and 27 above, Ishikawa et al. modified by Tanizawa and Watanabe et al. also disclose:

- The bonding-side semiconductor layer, which defined as a compound semiconductor layer including:
 - the second conductivity-type cladding layer 107 has a thickness of 1.0 μm disposed between the active layer 106 and the electrode contact layer 109 (Watanabe col. 10, line 67 to col. 11, line 2 and fig. 10);
 - a first layer (p-type low-doped layer 9) interface with electrode contact layer 10 (Tanizawa col. 14, lines 54-59);
 - a second layer (p-type second conductivity type cladding layer 8) located between the first layer and the active layer 7 (Ishikawa col. 10, lines 8-9), a portion of the second layer.

Allowable Subject Matter

Claims 21-22, 46-47, are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance:

The prior art of record does not disclose or suggest either in singly or in combination the following limitations and other elements in the claims:

References Ishikawa et al., Tanizawa, and Watanabe et al. do not disclose:

- the electrode contact layer has a composition of $\text{In}_x\text{Ga}_{1-x}\text{As}$;
- the In concentration profile decreases as receding from the ITO electrode;
- the Al-based insulating layer is formed over the entire portion of the non-formation region;

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (571) 272-1709. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wsl
March 20, 2005.

